

Carton, James, U. Maryland; Lumpkin, Rick, NOAA/AOML

## Long-term Variability of Global Ocean Near-surface Currents

2010

**Abstract:** The Global Drifter Program (former Surface Velocity Program, SVP) has been collecting near-surface ocean currents with surface drifters since 1979. Although drifter data coverage is spatially inhomogeneous, at least half of the World Ocean has velocity time series longer than 15 years. The availability of this data opens new opportunities to explore observationally how the ocean circulation responds to changing atmospheric climate forcing. In addition, this data provides a unique opportunity to test the dynamical cores of ocean and coupled models. But exploiting this unique data set is complicated by a possible bias introduced by changes in instrumentation. This is a joint UMD/AOML proposal to provide calibrated, unbiased long-term records of surface currents needed for climate research by accounting for the differences in measurements due to changes in the types of surface drifters. By addressing the problem of bias in the surface drifter records we will produce long-term and continuous records of World Ocean surface currents (addressing bullet #1 of CCDD FY10 call) and by examining these calibrated records in order to understand whether and to what extent the character of the ocean climate is variable or changing we will address bullet #3.

The evidence for bias in the surface drifter records comes from examination of long time series. This examination shows surface currents to be strengthening rapidly in the same direction as the direction of time-mean current throughout the World Ocean, without a corresponding strengthening of the surface wind field. In the Southern Ocean, for example, this strengthening is at least  $\bullet$  cm/s per year eastward, while in the trade wind regions, for example, this strengthening is up to  $\bullet$  cm/s per year westward. This proposal will explore the possibility that these apparent changes are at least partly the result of bias in the instrument record.

One hypothesis we will explore is that the apparent strengthening of current is the result of a change in the drogue design after year 2000 and that change's impact on the water-following characteristic of the drifters. In order to verify this explanation we will need first to update the drifter metadata in order to include information about the design of each drifter drogue. This updating will require a fair amount of technical work because information about drogue design is available only from hard copy archives. Once the metadata is updated we will look at quasimultaneous and spatially collocated data collected by drifters with different designs in order to parameterize the effects of the design change as a function of environmental parameters such as winds and currents. We will begin by fitting the bias to observed current, wind, and wave parameters. The auxiliary data needed for this study are available online. Winds are provided by the atmospheric reanalyses (e.g. NCEP/DOE) or satellite scatterometers (QuikSCAT) while wave parameters are available from simulations (NOAA WaveWATCH model) or satellite altimetry. Our determination of bias will be incomplete without also accounting for Stokes drift and drifter slip, both of which are important in the high wind regions like the South

Ocean. One outcome of the study will be a bias-corrected drifter data archive that will be made available via the NOAA/AOML servers, should such a bias be demonstrated in this study. A second outcome will be an evaluation of the nature and causes of low frequency changes in the near-surface circulation (on those time scales permitted by the data coverage). As part of the latter study we intend to perform comparisons of the surface currents with corresponding fields from ocean general circulation model simulations.